IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Patent Application of:

Frutschy, et al.

Serial No.: 09/473,305

Filed: December 28, 1999

For: DIRECT BGA ATTACHMENT WITHOUT SOLDER REFLOW

Attorney Docket No.: 42390.P7663

Art Unit: 2811

Examiner: N. Parekh

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

APPEAL BRIEF
IN SUPPORT OF APPELLANTS' APPEAL
TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Sir:

Applicants (hereafter "Appellants") hereby submit this Brief in triplicate in support of his Appeal from a final decision by the Examiner in the above-captioned case. Appellants respectfully requests consideration of this Appeal by the Board of Patent Appeals and Interferences for allowance of the claims in the above-captioned patent application.

An oral hearing is not desired.

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I. REAL PARTY IN INTEREST

The invention is assigned to Intel Corporation of 2200 Mission College Boulevard, Santa Clara, California 95052.

II. RELATED APPEALS AND INTERFERENCES

To the best of Appellants' knowledge, there are no appeals or interferences related to the present appeal, which will directly affect, be directly affected by, or have a bearing on the Board's decision.

III. STATUS OF THE CLAIMS

Claims 1, 2, 4, 12-16, 28, 32, and 33 are the subject of the present appeal.

Claims 1, 2, 4, and 12 stand rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,834,335 issued November 10, 1998 to Milton Buschbom (hereinafter "the Buschbom patent") in view of the Admitted Prior Art (hereinafter "the APA"), U.S. Patent No. 5,931,685 issued August 3, 1999 to Hembree, Jacobson, Wark, Farnworth, Akram and Wood (hereinafter "the Hembree et al. patent"), and U.S. Patent No. 5,329,423 issued July 12, 1994 to Kenneth Scholz (hereinafter "the Scholz patent"). Claims 13 and 14 stand rejected under 35 U.S.C. § 103(a) as being obvious over the Buschbom patent in view of the APA, the Hembree et al. patent, Scholz patent, and further in view of U.S. Patent No. 5,949,137 issued to Domadia et al. (hereinafter "the Domadia patent"). Claim 15 stands rejected under 35 U.S.C. § 103(a) as being obvious over the Buschbom patent, the APA, the Scholz patent, and further in view of U.S. Patent No. 6,137,161 issued October 24, 2000 to Gilliland et al. (hereinafter "the Gilliland patent"). Claim 16 stands rejected under 35 U.S.C. § 103(a) as being obvious over the Buschbom patent, the APA, the Hembree et al. patent, and further in view of the Gilliland patent, the Domadia patent, and U.S. Patent No. 5,783,461 issued July 21, 1998 to Hembree (hereinafter "the Hembree patent"). Claim 28 stands rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,812,378 issued September 22, 1998 to Joseph Fjelstad, et al. (hereinafter "the Fjelstad patent"). Claims 32 and 33 stand rejected under 35 U.S.C. § 103(a) as being obvious over the Hembree et al. patent in view of the Scholz patent.

IV. STATUS OF AMENDMENTS

In respons to the Final Office Action mailed on June 4, 2002, the Appellants timely filed a Notice of Appeal on September 8, 2003. In the December 27, 2000 Amendment, claims 1

and 12 were amended to more clearly define the invention as a non-reflow electrical contact with a solder ball between a substrate and a motherboard and claims 32 and 33 were added. In the September 20, 2001 Amendment, claim 28 was amended to more clearly define the position of the void, as illustrated in FIG. 2e. In the March 17 Amendment, independent claims 1 and 12 were amended to incorporate a limitation that was substantively presented in claim 7 (e.g., wherein said at least one of said at least one substrate contact and said at least one motherboard contact is recessed and has a semispherical surface which is substantially the same radius as a radius of said solder ball) and independent claim 28 was amended to incorporate a limitation that was substantively presented in claim 31 (e.g., wherein said at least one recessed substrate contact has a semispherical surface which is substantially the same radius as a radius of said solder ball).

A copy of all claims on appeal, claims 1, 2, 4, 12-16, 28, 32, and 33, is attached hereto as Appendix A.

IV. SUMMARY OF THE INVENTION

The present invention relates to apparatus for packaging microelectronic device. In particular, the present invention relates to a packaging technology that utilizes compression for achieving a BGA surface mount-type electrical connection between a microelectronic device and a carrier substrate. Background of the Invention, page 1, lines 5-8.

A variety of techniques are known for attaching microelectronic devices to carrier substrates, including direct surface mounting of the microelectronic device to the carrier substrate and socket mounting of the microelectronic device. Socket mounting may comprise a socket mounted on the carrier substrate wherein the microelectronic device is attached to the socket by pins protruding from the microelectronic device, or wherein the microelectronic device is pressed into the socket to achieve electrical continuity between a plurality of lands on the microelectronic device and a plurality of terminals on the socket. However, in low profile applications, the height of the attachment of the microelectronic device must be minimized. Thus, as sockets add an unacceptable height to the assembly, direct surface mounting is generally used for low profile applications. Background of the Invention, page 1, lines 9-22.

FIG. 5 illustrates an exemplary surface mounted land grid array 200 comprising a microelectronic device package 208 including a microelectronic device 202 attached to and in electrical contact with a first surface 206 of an interposer substrate 204 through a plurality of small solder balls 212 extending between contacts 214 on the microelectronic device 202 and

contacts 216 on the interposer substrate first surface 206. An underfill material 218 may be disposed between the microelectronic device 202 and the interposer substrate 204 to prevent contamination. A thermal interface (heat slug 222) for dissipation of heat generated by the microelectronic device 202 during operation may be attached thereto. The interposer substrate first surface contacts 216 are in electrical contact with contacts 224 on a second surface 226 of the interposer substrate 204 through a plurality of conductive traces extending through the interposer substrate 204. Background of the Invention, page 1, line 23 to page 2, line 11.

The electrical contact of the microelectronic package 208 to a carrier substrate 232 is achieved with a plurality of solder balls 234 which extend discretely between the interposer substrate second surface contacts 224 and contacts 236 on a first surface 238 of the carrier substrate 232. The solder balls 234 are reflowed (i.e., melted) which attaches the interposer substrate 204 to the carrier substrate 232. This form of electrical attachment is called a ball grid array ("BGA") attachment. The carrier substrate 232 includes conductive traces therein and/or thereon (not shown) which form electrical pathways to connection the first surface contacts 236 with external components (not shown). Background of the Invention, page 2, lines 12-20.

The microelectronic device 202 and the interposer substrate 204 may be supported by a support structure 242. The support structure 242 includes a frame 244, a backing plate 246, a thermal plate 248, and a plurality of retention devices (bolts 252 and nuts 254). The backing plate 246 is placed adjacent a second surface 256 of the carrier substrate 232. The frame 244 is placed adjacent to the carrier substrate first surface 238 and at least partially surrounds the microelectronic package 208. The thermal plate 248 abuts the heat slug 222 and extends over the frame 244. The bolts 252 extend through the backing plate 246, the frame 244, and the thermal plate 248, and are retained by nuts 254 threaded thereon. The frame 244 not only acts to support the assembly, but also acts as a stop to prevent overtightening of the retention devices, which could damage the microelectronic device. The thermal plate 248 is generally thermally conductive to assist the heat slug 222 in removing heat generated by the operation of microelectronic device 202. Background of the Invention, page 2, line 21 to page 3, line 11.

Although the surface mounted land grid array 200 shown in FIG. 4 achieves a low profile, the attachment of the microelectronic device package 208 to the carrier substrate 232 by reflowing of the solder balls 234 makes it difficult to remove the microelectronic device package 208 after attachment. This, in turn, makes it difficult to replace a defective microelectronic device (resulting in high rework costs) and makes it difficult for an end user or retailer to upgrade the microelectronic device. Background of the Invention, page 3, lines 12-17.

The present invention provides a surface mount-type microelectronic component assembly which does not physically attach the microelectronic component to its carrier substrate. Electrical contact is achieved between the microelectronic component and the carrier with solder balls attached to either the microelectronic component or the carrier substrate. A force is exerted on the assembly to achieve sufficient electrical contact between the microelectronic component and the carrier substrate. Thus, the present invention has advantages of a surface mounted assembly (low mounted height and low inductance due to a short electrical path between microelectronic component and carrier substrate), while also having the advantages of a socket-type assembly (easy removal and/or replacement of the microelectronic component). Detailed Description, page 5, line 15 to page 6, line 2.

FIG. 1 illustrates a microelectronic component assembly 100 according to one embodiment of the present invention. The microelectronic component assembly 100 includes a microelectronic device package 108 comprising a microelectronic device 102 attached to and in electrical contact with a first surface 106 of an interposer substrate 104. The attachment and electrical contact is achieved through a plurality of small solder balls 112 extending between contacts 114 on the microelectronic device 102 and contacts 116 on the interposer substrate first surface 106. It is, of course, understood that the microelectronic device 102 could be electrically attached to the interposer substrate 104 with a variety of techniques, including but not limited to conductive epoxy interconnects, lead finger connections, TAB connection, wire bonds, etc. An underfill material 118 may be disposed between the microelectronic device 102 and the interposer substrate 104 to prevent contamination. Further, a thermal interface (shown as heat slug 122) for dissipation of heat generated by the microelectronic device 102 during operation may be attached thereto. The interposer substrate first surface contacts 116 are in discrete electrical contact with contacts 124 on a second surface 126 of the interposer substrate 104 through a plurality of conductive traces extending through the interposer substrate 104. Detailed Description, page 6, lines 3-19.

The electrical contact of the microelectronic package 108 with a carrier substrate (such as a motherboard) 132 is achieved with a plurality of solder balls 134, which are formed (reflow) on the interposer substrate second surface contacts 124. The solder balls 134 extend discretely between the interposer substrate second surface contacts 124 and contacts 136 on a first surface 138 of the carrier substrate 132. The solder balls 134 are not physically attached to the carrier substrate contacts 136. Rather, the solder balls 134 make electrical contact by being pressed onto the carrier substrate contacts 136 by a support structure 142. The support

structure 142 also holds the microelectronic device 102 and the interposer substrate 104 in place. The solder balls 134 and the carrier substrate contacts 136 may be formed from any applicable conductive material. Detailed Description, page 6, line 20 to page 7, line 16.

The support structure 142 includes a frame 144, a backing plate 146, a thermal plate 148, and a plurality of retention devices (shown as bolts 152 and nuts 154). The backing plate 146 is placed adjacent a second surface 156 of the carrier substrate 132. The frame 144 is placed adjacent to the carrier substrate first surface 138 and at least partially surrounds the microelectronic device package 108. The frame 144 is preferably designed to reside close to the interposer substrate 104. The minimum clearance allows the frame 144 to align the solder balls 134 with their respective carrier substrate contacts 136. Furthermore, the frame 144 will act as a stop to prevent overtightening of the support structure 142. Detailed Description, page 7, line 17 to page 8, line 4.

The thermal plate 148 abuts the heat slug 122 and extends over the frame 144. The bolts 152 extend through the backing plate 146, the frame 144, and the thermal plate 148, and are retained by nuts 154 threaded thereon. The thermal plate 148, the frame 144, and backing plate 146 are preferably made of substantially rigid material, such as metal (e.g., aluminum), so that each are rigid enough not to flex or deform under pressure, as discussed below. Detailed Description, page 8, lines 5-10.

The thermal plate 148 is preferably thermally conductive to assist the heat slug 122 in removing heat generated by the operation of microelectronic device 102. It is, of course, understood that the heat slug 122 may not be necessary, as the thermal plate 148 may directly abut the microelectronic device 102 to dissipate the heat generated therefrom. Detailed Description, page 8, lines 11-15.

The support structure 142 further includes a resilient spacer 158 disposed between the interposer substrate first surface 106 and the thermal plate 148. The resilient spacer 158 is used to more evenly distribute pressure imposed by the support structure 142 across the interposer substrate 104. The support structure 142 is, thus, a compression mechanism for imparting pressure between the interposer substrate 104 and the carrier substrate 132. The pressure imposed on the resilient spacer 158 and the thermal interface is regulated by tightening or loosening the nuts 154 on the bolts 152, subject to a height of the frame 144 and the resilience of the resilient spacer 158. The pressure imposed on the resilient spacer 158 and the thermal interface presses the solder balls 134 against the carrier substrate contacts 136, which allows the solder balls 134 to achieve sufficient electrical contact with the carrier

substrate contacts 136 without having to reflow the solder balls 134. Detailed Description, page 8, line 16 to page 9, line 7.

As shown in FIG. 2d, carrier substrate contacts 136d may be substantially cup-shaped (i.e., semispherical), wherein the solder ball 134 is pressed against a curved surface 178 of the carrier substrate contact 136d residing within a semispherical recess 177 formed in the carrier substrate 132. The curved surface 178 is preferably configured to have a radius that substantially matches the radius of the solder ball 134 (both radii illustrated as element 176). Such a configuration provides high surface area contact of the solder ball 134 with the cup-shaped carrier substrate contact 136d. However, the configuration in FIG. 2d does not compensate for non-coplanarity of the solder balls 134. Thus, FIG. 2e illustrates an embodiment wherein the semispherical recess 177 is formed in the substrate 104 with a carrier substrate contact 136e extending over the semispherical recess 177 to form a void. Thus, the solder 134 and the carrier substrate contact 136e flex into the semispherical recess 177 when pressure is imparted thereon, which compensates for the non-coplanarity of the solder balls 134. FIG. 2f illustrates another embodiment wherein a resilient material layer 179 is disposed between the semispherical recess 177 and the carrier substrate contact 136f, wherein the resilient material layer 179 will flex to compensate for the non-coplanarity of the solder balls 134. Detailed Description, page 11, line 1-17.

It is, of course, understood that the present invention is not limited to attachment of an interposer substrate to a carrier substrate. The present invention may also be utilized to directly attach a microelectronic device (also broadly defined as a "substrate") to a carrier substrate. FIG. 3 illustrates such a microelectronic component assembly 180 wherein the microelectronic device 102 is attached to and in electrical contact with the contacts 136 on the first surface 138 of the carrier substrate 132. The attachment and electrical contact is achieved through a plurality of solder balls 134 formed (reflowed) on the microelectronic device contacts 114 which physically contact the carrier substrate contacts 136. A thermal interface (shown as heat slug 122) for dissipation of heat generated by the microelectronic device 102 during operation may be attached to the microelectronic device 102. As with the embodiment illustrated in FIG. 1, the support structure 142 provides the pressure for achieving the electrical contact between the microelectronic device 102 and the carrier substrate 132. However, the resilient spacer 158, as shown in FIG. 1, is not required as the support structure 142 will inherently distribute the pressure substantially evenly across the microelectronic device 102. It is, of course, understood that either the microelectronic device contacts 114 or the carrier substrate contacts 136 may

have a variety of configurations, such as illustrated in FIGs. 2a-2g. Detailed Description, page 11, line 18 to page 12, line 4.

VI. ISSUES PRESENTED

Whether claims 1, 2, 4, and 12 are obvious under 35 U.S.C. § 103(a) over the Buschbom patent in view of the APA, the Hembree et al. patent, and the Scholz patent.

Whether claims 13 and 14 are obvious under 35 U.S.C. § 103(a) the Buschbom patent in view of the APA, the Hembree et al. patent, Scholz patent, and further in view of the Domadia patent.

Whether claim 15 is obvious under 35 U.S.C. § 103(a) over the Buschbom patent, the APA, the Scholz patent, and further in view of the Gililand patent.

Whether claim 16 is obvious under 35 U.S.C. § 103(a) over the Buschbom patent, the APA, the Hembree et al. patent, and further in view of the Gilliland patent, the Domadia patent, and the Hembree patent.

Whether claim 28 is obvious under 35 U.S.C. § 103(a) over the Fjelstad patent.

Whether claims 32 and 33 are obvious under 35 U.S.C. § 103(a) over the Hembree et al. patent in view of the Scholz patent.

VII. GROUPING OF CLAIMS

For the purposes of this appeal:

Claims 1, 2, 4, 12-16, 32 and 33 stand or fall together as Group I, and;

Claim 28 stands as Group II, as claim 28 includes a limitation of a void between a conductive material and a recess, which is patentably distinct.

VIII. ARGUMENT

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

A. REJECTION OF CLAIMS 1, 2, 4, AND 12 UNDER 35 U.S.C. § 103(a) OVER THE BUSCHBOM PATENT IN VIEW IN APA, THE HEMBREE ET AL. PATENT AND THE SCHOLZ PATENT IS IMPROPER, AS THE REFERENCES DO NOT TEACH OR SUGGEST ALL OF THE CLAIM LIMITATIONS, AND NO REASONABLE SUGGESTION OR MOTIVIATION TO COMBINE THE REFERENCE HAS BEEN DEMONSTRATED. THUS, A PRIMA FACIE CASE OF OBVIOUSNESS HAS NOT BEEN ESTABLISHED

The Examiner has rejected claims 1, 2, 4, and 12 stand rejected under 35 U.S.C. § 103(a) as being obvious over the Buschbom patent in view of the APA, the Hembree et al. patent, and the Scholz patent.

The first independent claim, claim 1, is drawn to a microelectronic component assembly comprising a substrate having at least one contact, a motherboard having at least one contact; at least one solder ball extending between the substrate contact and the motherboard contact, wherein the solder ball is attached to one of the substrate contact and the motherboard contact, wherein at least one of the substrate contact and motherboard contact is recessed and has a semispherical surface which is substantially the same radius as a radius of the solder ball, and a compression mechanism for imparting pressure between the substrate and the motherboard. Claim 2 depends from claim 1 and includes the further limitation of the substrate comprising a microelectronic device package. Claim 4 depends from claim 1 and includes the further limitation of the substrate comprising a microelectronic device.

The second independent claim, claim 12, is drawn to a microelectronic component assembly comprising a substrate having a first surface and a second surface, wherein the first substrate first surface includes at least one contact; a motherboard having a first surface and a second surface; wherein the motherboard first surface includes at least one contact; at least one solder ball extending between the at least one substrate first surface contact and the at least one motherboard first surface contact, wherein the at least one solder ball is attached to one of the at least one substrate first surface contact and the at least one motherboard first surface contact, wherein the at least one of the at least one substrate contact and the at least one motherboard contact is recessed and has a semispherical surface which is substantially the same radius as a radius of the solder ball; and a support structure for imparting pressure between said substrate and said motherboard.

The June 4, 2003 Final Office Action contends at page 3 that the Buschbom patent teaches the present invention with exception of the PCB substrate being a motherboard and at

least one of at least one substrate contact and motherboard contact being recessed having a semispherical surface which is substantially the same radius as that of the solder ball. The June 4, 2003 Final Office Action relies on the APA for a teaching of a motherboard and relies on the Hembree et al. patent for an alleged teach of a recess having substantially the same diameter as the solder ball and the void is formed in the recess. The Scholtz patent is relied on for the premise of the solder ball being attached to the motherboard, rather than the chip as shown in the Buschbom patent.

Respectfully, it is the Appellants' contention that the Office has again (see the nearly 4 year prosecution history with two withdrawn Final Actions) presented a Final Rejection based on a misinterpretation. The Office Action has stated that the Hembree et al. patent "show the recess (Fig. 10A) where the width of recess is substantially same as a diameter of the solder ball and the void is formed in the recess (Col. 9, line 30)". Respectfully, this is believed to be incorrect. Elements 43 do not show the wall of a recess but are projections (like fins) that stick up. This is clear from Figure 10B (which shows a schematic bottom view of the contact bump of Figure 10A following contact with contact member of Figure 3F) wherein four grooves are imprinted into the solder ball from four projections 43. Oddly, this is exactly what the section of the Hembree et al. cited by the Office states. However, the Office does not seem to comprehend the structure of the Hembree et al. patent. For the convenience of the Board, col. 9, lines 28-32 of the Hembree et al. patent state "[a]lternately, as shown in FIGS. 10A and 10B two or more projections 43 can be formed in spaced arrays, adapted to retain and contact a single contact bump 12, 12A, 12B, 12W. In this case multiple grooves 53 can be formed in the contact bumps 12, 12A, 12B, 12W."

Clearly, FIG. 10A does not show a recess or void as contended by the Office, much less does it teach or suggest the limitation of independent claim 1 and independent claim 12 of "at least one of the at least one substrate contact and the at least one motherboard contact is recessed and has a semispherical surface which is substantially the same radius as a radius of the solder ball". Thus, the Office has not shown that the references, either alone or in combination, teach or suggest all of the limitations of the present claims, as required for a prima facie case of obviousness. Thus, the rejection of claim 1, 2, 4, and 12 is, respectfully, without merit.

Furthermore, the Office's motivation of "increased connection area" (see page 5) would not exist for the Hembree et al. patent, as the projections make very little contact with the solder ball (i.e., see the grooves 53 in Figure 10B). Thus, no relevant motivation has been given by

the Office with regard to the combination of the references. Therefore, the Office has failed to "present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references", as set forth in M.P.E.P. 706.02(j).

As the Board is aware, the mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992). Furthermore, a teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Appellants' disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). A showing of a suggestion, teaching, or motivation to combine prior teachings "must be clear and particular." In re Dembiczak, 175 F.3d 994, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999). The Hembree et al. patent does not support the motivation contention of "increased connection area". Thus, the rejection of claim 1, 2, 4, and 12 is, respectfully, without merit.

Therefore, as a prima facie case of obviousness has not been established, the Appellants submit that claims 1, 2, 4, and 12 recite patentable subject matter.

B. REJECTION OF CLAIMS 13 AND 14 UNDER 35 U.S.C. § 103(a) OVER THE BUSCHBOM PATENT IN VIEW OF THE APA, THE HEMBREE ET AL. PATENT, THE SCHOLZ PATENT AND THE DOMADIA PATENT IS IMPROPER, AS THE REFERENCES DO NOT TEACH OR SUGGEST ALL OF THE CLAIM LIMITATIONS, AND NO REASONABLE SUGGESTION OR MOTIVIATION TO COMBINE THE REFERENCE HAS BEEN DEMONSTRATED. THUS, A PRIMA FACIE CASE OF OBVIOUSNESS HAS NOT BEEN ESTABLISHED

The Examiner has rejected claims 13 and 14 under 35 U.S.C. § 103(a) as being obvious over the Buschbom patent in view of the APA, the Hembree et al. patent, Scholz patent, and further in view of the Domadia patent.

Claim 13 depends from claim 12 and includes the further limitation of the support structure comprising a frame surrounding a portion of said substrate, a backing plate abutting said motherboard, a thermal plate extending over said frame and adjacent said substrate second surface, and a plurality of retention devices extending through said backing plate, said frame, and said thermal plate. Claim 14 depends from claim 13 and includes the further limitation of the plurality of retention devices comprises a plurality of bolts having at least one nut retaining each of the bolts.

As previously discussed, no reasonable suggestion or motivation to combine the Buschbom patent, the APA, the Hembree et al. patent, and the Scholz patent has been presented. Furthermore, the Buschbom patent, the APA, the Hembree et al. patent, and the Scholz patent, either alone or in combination, neither teach nor suggest all of the limitations of the claim 12, from which claims 13 and 14 depend (in specific, they fail to teach or suggest "at least one of the at least one substrate contact and the at least one motherboard contact is recessed and has a semispherical surface which is substantially the same radius as a radius of the solder ball"). Moreover, the Domadia patent does not fill this gap in the teaching, as it is only relied upon for details of the support structure.

Therefore, as a prima facie case of obviousness has not been established, the Appellants submit that claims 13 and 14 recite patentable subject matter.

C. REJECTION OF CLAIMS 15 UNDER 35 U.S.C. § 103(a) OVER THE BUSCHBOM PATENT, THE APA, THE SCHOLZ PATENT, AND THE GILILAND PATENT IS IMPROPER, AS THE REFERENCES DO NOT TEACH OR SUGGEST ALL OF THE CLAIM LIMITATIONS, AND NO REASONABLE SUGGESTION OR MOTIVIATION TO COMBINE THE REFERENCE HAS BEEN DEMONSTRATED. THUS, A PRIMA FACIE CASE OF OBVIOUSNESS HAS NOT BEEN ESTABLISHED

The Examiner has rejected claim 15 under 35 U.S.C. § 103(a) as being obvious over the Buschbom patent, the APA, the Scholz patent, and the Gililand patent.

Claim 15 depends from claim 12 and further including the limitation of the substrate comprising a microelectronic device package including a microelectronic device attached to and in electrical contact with a first surface of an interposer substrate, and wherein the at least one substrate first surface contact comprising at least one contact on a second surface of said interposer substrate.

As previously discussed, no reasonable suggestion or motivation to combine the Buschbom patent, the APA, the Hembree et al. patent, and the Scholz patent has been presented. Furthermore, the Buschbom patent, the APA, the Hembree et al. patent, and the Scholz patent, either alone or in combination, neither teach nor suggest all of the limitations of the claim 12, from which claims 15 depends (in specific, they fail to teach or suggest "at least one of the at least one substrate contact and the at least one motherboard contact is recessed and has a semispherical surface which is substantially the same radius as a radius of the solder

ball"). Moreover, the Gililand patent does not fill this gap in the teaching, as it is only relied upon for teaching an interposer substrate.

Therefore, as a prima facie case of obviousness has not been established, the Appellants submit that claim 15 recites patentable subject matter.

D. REJECTION OF CLAIM 16 UNDER 35 U.S.C. § 103(a) OVER THE BUSCHBOM PATENT, THE APA, THE HEMBREE ET AL. PATENT, THE GILILAND PATENT, THE DOMADIA PATENT, AND THE HEMBREE PATNET IS IMPROPER, AS THE REFERENCES DO NOT TEACH OR SUGGEST ALL OF THE CLAIM LIMITATIONS, AND NO REASONABLE SUGGESTION OR MOTIVIATION TO COMBINE THE REFERENCE HAS BEEN DEMONSTRATED. THUS, A PRIMA FACIE CASE OF OBVIOUSNESS HAS NOT BEEN ESTABLISHED

The Examiner has rejected claim 16 under 35 U.S.C. § 103(a) as being obvious over the Buschbom patent, the APA, the Hembree et al. patent, and further in view of the Gilliland patent, the Domadia patent, and the Hembree patent.

Claim 16 depends from claim 15 and includes the further limitation of the support frame comprising a frame surrounding a portion of the substrate, a backing plate abutting the motherboard second surface, a thermal plate extending over the frame and adjacent the substrate second surface, a plurality of retention devices extending through the backing plate, the frame, and the thermal plate, and a resilient spacer extending between the thermal plate and the interposer substrate.

As previously discussed, no reasonable suggestion or motivation to combine the Buschbom patent, the APA, the Hembree et al. patent, and the Scholz patent has been presented. Furthermore, the Buschbom patent, the APA, the Hembree et al. patent, and the Scholz patent, either alone or in combination, neither teach nor suggest all of the limitations of the claim 12, from which claims 13 and 14 depend (in specific, they fail to teach or suggest "at least one of the at least one substrate contact and the at least one motherboard contact is recessed and has a semispherical surface which is substantially the same radius as a radius of the solder ball"). Moreover, neither the Gililand patent, the Domadia patent, and the Hembree patent, either alone or in combination, do not fill this gap in the teaching, as they only relied upon for teaching details of the support frame.

Therefore, as a prima facie case of obviousness has not been established, the Appellants submit that claim 16 recites patentabl subject matter.

E. REJECTION OF CLAIM 28 UNDER 35 U.S.C. § 103(a) OVER THE FJELSTAD PATENT IS IMPROPER, AS THE REFERENCES DO NOT TEACH OR SUGGEST ALL OF THE CLAIM LIMITATIONS, AND NO REASONABLE SUGGESTION OR MOTIVIATION TO MODIFY THE REFERENCE HAS BEEN DEMONSTRATE. THUS, A PRIMA FACIE CASE OF OBVIOUSNESS HAS NOT BEEN ESTABLISHED

The Examiner has rejected claim 28 under 35 U.S.C. § 103(a) as being obvious over the Fjelstad patent.

Independent claim 28 is drawn to a substrate contact for forming a non-reflow electrical contact with a solder ball comprising a recess defined in a substrate by at least one surface extending into said substrate, and a conductive material layered over said recess forming a void therebetween, wherein said conductive material forms a semispherical surface which substantially conforms to the surface of said solder ball.

The Fjelstad patent illustrates a conductive material having projections 42 over a hole 36 in a substrate. However, the Fjelstad patent does not teach that the conductive material forming a semispherical surface which substantially conforms to the surface of the solder ball. At best, the projections 42 merely bend and make contact with the bump lead 70, during insertion and retention (i.e., FIG. 5 and 6). Thus, it is clear that projections 42 do not form a semispherical surface.

In fact, the June 6, 2003 Final Office Action admits this and contends that "an embodiment in Fig. 18 where the conductive material/contact projection (742 in Fig. 18) has two portions of semispherical surface substantially conforming and contacting the bottom surface of the solder/metal ball". Again, this is a misinterpretation of the teaching of a reference. The Board attention is directed to FIG. 19, which is a top view of the contacts of FIG. 18. Projections 742 are simply conductive fingers, which, when placed in contact with a solder ball 770 would each make a single point of contact with solder ball 770, and would certainly not form "a semispherical surface which substantially conforms to the surface of said solder ball", as required by claim 28. In other words, claim 28 requires a surface to surface contact, not a point to point contact shown in the Fjelstad patent.

The June 6, 2003 Final Office Action then contends that it would have been obvious "to incorporate the conductive material forming the semispherical surface which substantially conforms to the surface of the solder ball so that the contact area between the solder ball and the conductive lead can be increased in Fjelstad et al.'s assembly. However, the Office has demonstrated no such sugg stion or motivation within the reference.

Again as the Board is aware, the mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992). Furthermore, a teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Appellants' disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). A showing of a suggestion, teaching, or motivation to combine prior teachings "must be clear and particular." In re Dembiczak, 175 F.3d 994, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999). The June 6, 2003 Final Office Action has demonstrated none this.

Therefore, as a prima facie case of obviousness has not been established, the Appellants submit that claim 28 recites patentable subject matter.

F. REJECTION OF CLAIMS 32 and 33 UNDER 35 U.S.C. § 103(a) OVER THE HEMBREE ET AL. PATENT IN VIEW OF THE SCHOLZ PATENT IS IMPROPER, AS THE REFERENCES DO NOT TEACH OR SUGGEST ALL OF THE CLAIM LIMITATIONS, AND NO REASONABLE SUGGESTION OR MOTIVIATION TO COMBINE THE REFERENCE HAS BEEN DEMONSTRATE. THUS, A PRIMA FACIE CASE OF OBVIOUSNESS HAS NOT BEEN ESTABLISHED

The Examiner has rejected claims 32 and 33 under 35 U.S.C. § 103(a) as being obvious over the Hembree et al. patent in view of the Scholz patent.

Independent claim 32 is drawn to a substrate contact for forming a non-reflow electrical contact with a solder ball comprising a semispherical recess defined in a substrate by at least one surface extending into said substrate, a conductive material layered in said semispherical recess, and an upper surface of said conductive material layer having a radius which is substantially the same as a radius of said solder ball. Claim 33 depends from claim 32 and includes the further limitation of a resilient material disposed between said substrate and said conductive material layer.

With regard to claims 32 and 33, the June 6, 2003 Final Office Action correct states that the Hembree et al. patent does not teach or suggest a contact with a semispherical surface which is substantially the same radius as a radius of the solder. However, to overcome this lack of teaching or suggestion, the June 6, 2003 Final Office Action restates the erroneous

interpretation of the structure of Fig. 10A (see discussion with regard to the rejection of claims 1, 2, 4, and 12). Therefore, this argument is without merit.

Furthermore, the Office Action contends that the Scholz patent teaches "recesses having semispherical or trapezoidal shape are dimensioned to fit the radius/curvature of the tip portion of the contact bumps." This is a strained argument at best. The Scholz patent shows contact bumps with curved edges, not a solder ball as claimed in the present claims. Further, the Scholz patent merely shows a trapezoidal shape, which is deformed by the curved edges of contact bumps, not semispherical, as claimed in the present claims.

The June 6, 2003 Final Office Action at page 13, contend that it would have been obvious "to select the recess being semispherical in shape". Again as the Board is aware, the mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992). Furthermore, a teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Appellants' disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). A showing of a suggestion, teaching, or motivation to combine prior teachings "must be clear and particular." In re Dembiczak, 175 F.3d 994, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999). The June 6, 2003 Final Office Action has demonstrated none this.

Therefore, as a prima facie case of obviousness has not been established, the Appellants submit that claims 32 and 33 recites patentable subject matter.

IX. CONCLUSION

Appellants respectfully submit that all the pending claims in this patent application are patentable and request that the Board of Patent Appeals and Interferences overrule the Examiner and direct allowance of the rejected claims.

This brief is submitted in triplicate, along with a check for $330.00 to cover the appeal fee for one other than a small entity as specified in 37 C.F.R. § 1.17(c).

Respectfully submitted,

Date: November 10, 2003

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Signature

11/10/03
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APPENDIX A: CLAIMS ON APPEAL

1. A microelectronic component assembly, comprising:

a substrate having at least one contact;

a motherboard having at least one contact;

at least one solder ball extending between said at least one substrate contact and said at least one motherboard contact, wherein said at least one solder ball is attached to one of said at least one substrate contact and said at least one motherboard contact;

wherein said at least one of said at least one substrate contact and said at least one motherboard contact is recessed and has a semispherical surface which is substantially the same radius as a radius of said solder ball; and

a compression mechanism for imparting pressure between said substrate and said motherboard.

2. The microelectronic component assembly of claim 1, wherein said substrate comprises a microelectronic device package.

4. The microelectronic component assembly of claim 1, wherein said substrate comprises a microelectronic device.

12. A microelectronic component assembly, comprising:

a substrate having a first surface and a second surface, wherein said first substrate first surface includes at least one contact;

a motherboard having a first surface and a second surface; wherein said motherboard first surface includes at least one contact;

at least one solder ball extending between said at least one substrate first surface contact and said at least one motherboard first surface contact, wherein said at least one solder ball is attached to one of said at least one substrate first surface contact and said at least one motherboard first surface contact;

wherein said at least one of said at least one substrate contact and at least one motherboard contact is recessed and has a semispherical surface which is substantially the same radius as a radius of said solder ball; and

a support structure for imparting pressure between said substrate and said motherboard.

13. The microelectronic component assembly of claim 12, wherein said support structure comprises:

a frame surrounding a portion of said substrate,

a backing plate abutting said motherboard;

a thermal plate extending over said frame and adjacent said substrate second surface; and

a plurality of retention devices extending through said backing plate, said frame, and said thermal plate.

14. The microelectronic component assembly of claim 13, wherein said plurality of retention device comprise a plurality of bolts having at least one nut retaining each of said plurality of bolts.

15. The microelectronic component assembly of claim 12, wherein said substrate comprises a microelectronic device package including a microelectronic device attached to and in electrical contact with a first surface of an interposer substrate, and wherein said at least substrate first surface contact comprises at least one contact on a second surface of said interposer substrate.

16. The microelectronic component assembly of claim 15, wherein said support frame comprises

a frame surrounding a portion of said substrate,

a backing plate abutting said motherboard second surface;

a thermal plate extending over said frame and adjacent said substrate second surface;

a plurality of retention devices extending through said backing plate, said frame, and the thermal plate; and

a resilient spacer extending between said thermal plate and said interposer substrate.

28. A substrate contact for forming a non-reflow electrical contact with a solder ball, comprising:

a recess defined in a substrate by at least one surface extending into said substrate; and

a conductive material layered over said recess forming a void therebetween, wherein said conductive material forms a semispherical surface which substantially conforms to the surface of said solder ball.

32. A substrate contact for forming a non-reflow electrical contact with a solder ball, comprising:

a semispherical recess defined in a substrate by at least one surface extending into said substrate;

a conductive material layered in said semispherical recess; and

an upper surface of said conductive material layer having a radius which is substantially the same as a radius of said solder ball.

33. The substrate contact of claim 32, further including a resilient material disposed between said substrate and said conductive material layer.